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NOTES OF A VISIT
TO
SCIENTIFIC SCHOOLS AND MUSEUMS
IN THE
UNITED STATES

By Principal DAWSON, LL.D., F.R.S., &c.

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Away from snow and frost, on the rail, rapidly sweeping through New England villages with their snug homes and busy factories, we approach the great western emporium, the lesser London, the commercial capital of the "greater Britain" of the western world—already numbering its million and a half of people, and rivalling old London in all the higher and lower phases of a city life. Our business is not with either its trade or its gaiety. We have first to tell to such of its people as care to know of such old world things, our story about "Primeval Forests," and then to scrutinise, under the guidance of our friend Dr. Newberry, the class-rooms, laboratories and museums of Columbia college, a workshop of mind, aiming to train young men to that practical grasp of science which shall enable them to apply its principles to the better extraction and working into useful purposes of the dark treasures of mother earth. Columbia College is a brick building in a quaint old fashioned square, once out of town, but overgrown by the rapid increase of the great city, which swallows up farms, estates, and country houses as if they were mere morsels to its voracious appetite. The building, which was intended for an asylum, forms three sides of a quadrangle, and has many long narrow rooms well lighted by windows in the sides. It is regarded as merely a temporary

residence for the college, whose large endowment of nearly \$1,500,000 is being in great part retained by its trustees as a basis for more extended operations than those of the present "School of Mines." Still it is well adapted to its use, and has been admirably arranged. Three of its long rooms, like the wards of a hospital, but with tables and shelves instead of beds, are fitted up as working laboratories in which a hundred and twenty students may at once pursue qualitative and quantitative analysis. Another room in the basement is furnished with furnaces and other appliances for assaying in the dry way. Another is arranged for drawing, and there are several plainly furnished but commodious class rooms. One of the rooms is devoted to the collection of minerals, which is very neatly arranged in flat cases, with abundant illustrations of crystalline forms interspersed. Another contains the collections of geology and palæontology, in great part consisting of the private cabinet of Professor Newberry, and especially rich in the flora of the coal period, and in illustrations of the ores and other economic products of America.

The staff of Columbia College consists of eighteen Professors, lecturers, and assistants, representing the subjects of mineralogy, metallurgy, chemistry, botany, mathematics, mechanics, physics, geology and palæontology, assaying and drawing. Its course extends over three years, and embraces the work necessary to qualify for practical operations in mineral surveying, mining, metallurgy and practical chemistry. Students are required on entrance to pass an examination in algebra, geometry and trigonometry. Though it has been in operation on its present basis only for a few years, it had in its last catalogue 109 students, the greater part of whom, on attaining to the degree of "Engineer of Mines" or "Bachelor of Philosophy," will go out as practical workers in mines and manufactories. An important feature of the course is that students are expected in the vacation to visit mines and metallurgical and chemical establishments, and to report thereon and make illustrative collections; while during the session short excursions are made to machine shops and metallurgical establishments in and near the city. It is probable that Columbia College is little cared for or thought of by the greater part of the busy multitudes of New York; yet if a map of the city were made on the principle of the missionary maps, but illustrating the places where true industrial progress is being pro-

vided for, it would be a very white spot, though but a very small one, in the great Babel.

From New York to New Haven is from a great city with small science to a small city in which science bulks relatively larger. On Christmas Day we looked in upon Professor Marsh, almost buried among all that is richest and rarest in new scientific literature and choice specimens, and enjoyed again the genial look and kindly greeting of our friend Silliman, and chatted for a little with the keen philosophic Dana, shattered indeed in health, but still growing inwardly in spirit. The Sheffield Scientific School is a modern outgrowth of the old University of Yale College; and originated in 1847 in the organization of the "Department of Philosophy and Arts," under Professors Silliman and Norton, representing respectively the subjects of Applied Chemistry and Agriculture. The scheme seems to have been devised by the elder Silliman, and to have had its birth in his private efforts in previous years to give practical instruction to special students. This department was maintained with moderate success for several years; but at length in 1860 Mr. Sheffield, a wealthy citizen of New Haven, came forward to its aid with the handsome gift of a building and apparatus valued at over \$50,000 and a fund of \$50,000 more to endow Professorships of Engineering, Metallurgy and Chemistry. This enlightened benefaction at once placed the school on a respectable footing, and in 1863 it was further enlarged by the application to its use of the share of the State of Connecticut in the large grants of land made by Congress in that year for purposes of scientific education,—grants which have borne similar good fruit in many other States. The Sheffield School will also be a large sharer in the benefits which the University will derive from the great Museum founded by Mr. Peabody, and endowed by him with the sum of \$150,000. The present extremely valuable collections of Yale College are stored in rooms of quite inadequate dimensions, and are being rapidly augmented and improved. Prof. Marsh and Prof. Verrill alone have vast stores of fossils, corals and other specimens, in basements and cellars; and when the whole shall be arranged in Mr. Peabody's Museum, Yale College will be inferior to few Academic institutions in the world in regard to its facilities for teaching the science of nature through the eye. A special collection in the Sheffield School, very valuable and well worthy of study, is that

of economic geology. It is admirably arranged, and gives at one view an idea of nearly all the sources of the mineral wealth of the United States from the Atlantic border to the Pacific.

The building of the Sheffield School is better than that of Columbia College, though it is an old medical school adapted to its present use; and the scope of the institution is wider, including six distinct courses, any of which may be followed by the student. These are: 1st, Chemistry and Mineralogy; 2nd, Engineering and Mechanics; 3rd, Mining and Metallurgy; 4th, Agriculture; 5th, Natural History and Geology; 6th, A Select Scientific and Literary Course. The class-rooms and laboratories struck me as remarkably ingenious and neat in all their arrangements, and combining in a great degree all possible contrivances for the convenience of Professors and students. The bungling and uncomfortable arrangements too often seen in Academic rooms had evidently here been replaced by the exercise of some engineering and mechanical skill and contrivance, and by a combination of lecture room and cabinet the means of illustration had been rendered extremely accessible. In token that the Sheffield School is not altogether a school of mines looking down into the bowels of the earth, its liberal founder has presented it with an Equatorial Telescope, made by Clark, with an object glass having an aperture of nine inches. It is placed in a tower constructed for it; and with a meridian circle and other instruments, enables students to learn all the work of a regular observatory, as well as the operations of astronomical geodesy. Any one interested in the training of the young men of Canada can scarcely avoid a feeling of envy in visiting such an institution as this, furnished with so many facilities for enabling the active mind of youth to grasp all that is of practical utility or provocative of high and noble thought in the heaven above and in the earth beneath. At this moment a Canadian Sheffield, judiciously aiding any University having an adequate and permanent basis, would do more to promote the trade and manufactures of this country, and its scientific reputation, than can be done by any other agency.

The faculty of the Sheffield School includes twenty-three names, and its roll of students numbers one hundred and forty. It is scarcely necessary to say that several of the Professors at Yale are active and successful original workers, and that the place is not only an effective scientific school, sending out each

year a large corps of trained men into the higher practical pursuits connected with science, but also an important centre of discovery and original investigation, further materials for which are being constantly accumulated. More especially in geology, mineralogy, palæontology, zoology and chemistry, are such men as Dana, Silliman, Marsh, Brush and Verrill adding to the stock of knowledge for the whole world, as well as training their students. And this one of the results in all cases of a well appointed and efficient school of science.

Crossing the dark harbour of New York, cumbered with cakes of ice; and rapidly rolling over flat New Jersey, interesting for its curious deposits of the green-sand of the old Cretaceous Sea, now quarried as a manure, and to be seen in heaps green almost as grass, by the roadside, we reach pleasant, quiet Philadelphia, in which among chief objects of interest to a scientific traveller, are the collections of its old and useful Academy of Sciences, a scientific workshop as vigorous in its age as any of its more youthful rivals, though sadly in want of enlarged apartments for its collections. Hawkins had just been setting up here the skeleton of the Hadrosaurus of the New Jersey green-sand, one of the most portentous of those old reptiles of that Mesozoic age, when the giant "tanninim" were the lords of creation. It must have been a creature four-fifths reptile and the rest bird, standing upright twenty feet in height, on two enormous legs with three-toed feet, and an immense pillar-like tail, while its small fore feet were used as hands to aid it in obtaining the fruits or other vegetable substances on which it fed. It might be described as a gigantic reptilian kangaroo with the toes of a bird; and were it not for the actual bones proving that it had existed, a zoologist would scarcely have the hardihood to imagine such a creature in his dreams. We stand amazed beside the skeleton of the Mastodon or the Megatherium, but not with the feeling almost of disbelief in our senses excited by the strange combination of characters in this wonderful animal, which among other things shows how the apparent bird-tracks of the Mesozoic rocks, or some of them, may have been made by biped reptiles, strange and gigantic anticipations of the attitude of man himself. As a companion, or rather a formidable enemy, to this animal, Mr. Cope, who is studying these remains, showed me portions of the skeleton of a gigantic carnivorous reptile of the same age, with formidable teeth like those of *Megalosaurus*, and

hooked eagle-like claws which must have been ten inches in length. The collections of the Academy are of immense value, and its Scientific Library is very complete, but it greatly lacks room and light. Efforts are now being made to secure a better building. Among other things it possesses an extremely valuable and very complete collection of American skulls, which have afforded materials to Morton, Wilson and Meigs for elaborate investigations on the cranial characters of races, and which are scarcely yet exhausted as sources of information on this very important subject.

Two works are now in progress in Philadelphia, which will be of great value to students of American Palaeontology. One is a monograph on American fossil mammals, by Leidy; the other a monograph on American fossil reptiles, by Cope. One of these is to be published in the Transactions of the Philosophical Society; the other in those of the Academy,—both active Societies and fellow-workers in the cause of science.

Baltimore, though a queenly city, does not stand so high as Philadelphia in scientific work. It has, however, its Academy with a band of zealous naturalists, of whom Tyson, Morris and Dalrymple were old friends, and others I was glad to meet for the first time. The vicinity of the city presents a strange association of old and new rocks, characteristic of that line of junction of the more recent formations of the coast with old metamorphic rocks, on which so many American cities have been placed. In the quarries near the town are gneiss, hornblende schist and granite, which have much of the aspect of Laurentian rocks, and according to Mr. Tyson's sections may be of that age. To a northern visitor they are remarkable for the depth to which they have been decomposed by the weather. Similar rocks in Canada usually present a hard polished surface, as if incapable of decomposition; here there are many feet of "rotten rock" at the surface. The causes may be: 1st, the more rapid waste of felspathic rocks under a warmer climate and a larger rain-fall; 2nd, the want of a tenacious clay covering; 3rd, the absence of the great Northern drift and its ice-striation and polishing. There does not seem to be any evident difference in the composition of the rocks to account for it. Another point of interest is the extremely red colour of the sand formed from the decomposition of the hornblende portions of the rock. The oxide of iron resembles anhydrous peroxide in its colour; and the sand formed from it

would give a very good red sandstone. Many ages of subaerial decomposition of rocks like these, followed by rapid denudation, would give red sandstone rocks like those which appear in so many geological periods.

Among these ancient rocks, there appear beds of white, red and dark gray clay. In the latter there are numerous trunks of trees converted into lignite, and layers of nodules of carbonate of iron, which are extracted in large quantities as an ore of the metal. It appears that in the lower beds of this formation well preserved trunks of Cycads are found, and the whole are regarded by Mr. Tyson as possible representatives of the Wealden. In one of the fossil trunks I observed a portion of charcoal perfectly representing the mineral charcoal which occurs under similar conditions in the coal formation; and in this comparatively modern formation, deposited probably in a lagoon or estuary, the conditions of deposition of the clay-ironstones of the coal-measures are perfectly reproduced.

The Peabody Institute at Baltimore is a remarkable monument of the generosity of a man celebrated for his princely munificence. Mr. Peabody resided for some time in Baltimore, and, as an evidence of his regard for its welfare, he has presented to it the sum of one million of dollars, for the establishment of an Institute, the primary objects of which are stated to be—1st, an extensive library; 2nd, the delivery of lectures in science and literature, and in connection with this the provision of prizes and medals for competition in the high schools in the city; 3rd, an Academy of Music, and 4th, a Gallery of Art. In pursuance of these objects a plain but substantial and commodious building of white marble has been erected, and a library of the greatest possible excellence is rapidly being accumulated, while progress is being made in all the other objects contemplated. The Institute is already, in its Library, Lectures and Academy of Music, an inestimable boon to the city, and must speedily have a marked effect on the interests of literature and science. A museum is not at present contemplated; but if not otherwise provided for, it would be a worthy object to attempt, in such an institute, a representation at least of the geology and natural history of the State, which might do much to promote the development of its resources, as well as the education of its young men. The Provost, Mr. Morrison, is evidently earnest and enthusiastic in the good work in which he is employed, and the Librarian, Mr. Uhler, from his knowledg ef

Natural Science, is specially fitted to take a practical view of the scientific part of the Library, and to be of service in the organization of a Museum should this be undertaken.

Such endowments as this of Mr. Peabody give to the United States an enviable eminence among the nations of the earth, in the promotion of popular culture and scientific progress. They constitute an unmistakeable evidence of the wisdom of the early American colonists in making provision for the general diffusion of education, and they show that in the future this great country is destined to be unrivalled in its means, whether in books, apparatus, collections, or teachers, for the development of the greatest of all the resources of nations—mind. Already it is outbidding the old world in the market of teaching labour, and of rare and costly specimens and books; and the growth, side by side, of its wealth and culture, must accelerate this more and more.

More fortunate than the belligerent Southerners, I found means to extend my peaceful raid into the heart of Washington itself; which, in a scientific sense, is the Smithsonian Institution, and in that of hospitality and kindly greeting, nowhere warmer than in Prof. Henry and his family. Washington seems to have grown and thriven on the war, but still presents the old contrast of massive and impressive public buildings with comparatively plain and even mean private residences, a point in which it differs from all the other great cities of America; but the reason readily appears from a consideration of its political circumstances. The Smithsonian Institution is cosmopolitan in its aims—its object being “the increase and diffusion of knowledge among men.” This object, as wisely interpreted by Prof. Henry, is not to promote local ends, but those in which the world is interested; not to do that which any one can profitably do, but that which, while important in itself, cannot be done by other means. Thus peculiar in its aims, the Institution has to forego many tempting roads to popularity, yet like other good things it seems to be popular in spite of itself. Practically, as the great current of science on this continent necessarily runs much in the channel of discovery in Geology and Natural History, the work of the Institution lies much in this direction, and no institute in America has rendered more important aids to the prosecution of Natural Science. Its collections, under the skilful superintendence of Prof. Baird, are a marvel of system and careful arrangement; and are open to the inspection and study of naturalists from any part of the world; who are in some cases

accommodated with rooms for their work as well as access to specimens. Its publications have given to the world a great mass of matter which would otherwise have been inaccessible to students. Its facilities for intercommunication and exchanges between scientific men, involving an immense amount of detail, have been of the utmost service, and its liberal disposal of duplicate specimens has strengthened the hands of students and teachers far and wide.

Prof. Henry and his assistants are at present giving much attention to the collection of American antiquities, and have accumulated a very large and instructive assemblage of objects of aboriginal art from all parts of the continent. The effort is a most important one. America, with its modern stone age, must eventually furnish the clue to the right interpretation of the immense quantity of facts as to the stone and bone age of Europe now being accumulated, and of which the chronology is at present so strangely, and even absurdly, exaggerated by the majority of European archaeologists.

It is a wide leap to pass from the arrow-heads and stone axes of the Aboriginal Indians to the multitudinous inventions of the modern Americans, but the transition is easily made by passing from the Smithsonian to the noble white marble building designated by the humble name of Patent Office, and inspecting its thousands of feet of glass cases crammed with machines and models, ingenious and stupid, useful and useless; but all monuments of the many inventions of scheming minds. The Patent Office is a vast and well arranged museum of useful art, but its cases are so numerous and so crowded with objects, that a non-professional visitor is simply bewildered, and contents himself with a general glance at the whole. In the lower hall there stands an object suggestive in several ways. It is the marble statue of Washington by Powers, sent during the late war by General Butler from Baton Rouge, in imitation, perhaps, of certain Generals of ancient Rome and modern France, in their treatment of works of art. It is a fine figure, somewhat idealised perhaps, but giving a far better conception of the temperament and aspect of the great American General than the current portraits.

A very interesting collection, known as the Army Medical Museum, has been formed in Ford's theatre, the building in which Lincoln was assassinated. It is a marvel of careful mounting and preparation, and in this respect alone is well worthy of a

visit from any one interested in the best mode of exhibiting objects in a museum. It is of great professional value; and independently of this, it possesses a melancholy interest in its profuse exhibitions of the effects of shot, shell and other implements of destruction, on the poor human frame. Almost every conceivable form of injury received in war is here exhibited by preparations, every one of which tells not only the history of a surgical case, but a tale of suffering and death. A strange commentary it is on the humanity of a christian and civilized age to see these beautifully fashioned and fitted human bones, splintered by the rude violence of deadly missiles, and now mounted with all the dainty skill of the anatomical preparator. In flat cases, where they are much better seen than as ordinarily arranged in wall cases, are a few interesting American skulls—some of supposed mound-builders of the West, others of rude Indian tribes, and a few Mexican and Peruvian. One cannot fail to be struck, even on a cursory inspection of these skulls, as well of as the larger series in the Academy of Sciences in Philadelphia and in the Smithsonian, with such general views as the following;—1st. That there is one prevalent and somewhat long-headed form of skull very generally distributed in America; 2nd. That there are occasional and peculiar short-headed forms; 3rd. That some of the latter, as well as some of the long and narrow forms, are the results of artificial compression; 4th. That the skulls of the more civilized races are of a finer and more delicate type; 5th. That there is a strong resemblance between the ordinary American forms and those of the skulls of ancient and rude European and African tribes. These are general truths which rise out of the mass of details noticed by craniologists, and which are eminently suggestive as to the relationships and affiliations of men.

In leaving the museum I paused to look at two little glass cases containing two modern mummies of Indian children, in excellent preservation. One is a Flathead child, its skull compressed in the strange fashion of that tribe—its feet gathered up to its chest, its shrunken frame carefully wrapped in cloth, and on its breast bearing a necklace of beautiful Dentalium shells, the most precious treasure of the west coast, mixed with a few glass beads, perhaps almost as precious. The other is a Dakotah child, in full dress, with neatly made coat and leggins, and prettily worked mocassins, and a broad collar of white and blue beads and brass buttons neatly strung on leather. These, though

quite modern, reminded me of the quantities of precious strings of wampum—laid up in some ancient graves of Indian babes in British America, and which remain after the furs, no doubt clothing the bodies, have decayed. A higher phase of our humanity is represented by these remains than by the inventions of the Patent Office—the love that survives the death of its object, and which, in the absence alike of human philosophy and Divine revelation, preaches with a force stronger than sense and mere reason, that the loved one “is not dead but sleepeth,” and will awake in another world, whither affection can follow it only by decking its poor remains in the best robe and burying it with the most costly treasures. Such faith in the Indian mother may be very simple and ignorant; but it is surely a better and holier thing than that cold skepticism which, while grovelling in a base selfishness, looks up in its higher flights of reason and imagination to tell us that man is but a better kind of brute, an aggregate of blind material forces.